AM / FM STEREO TUNER

T-88V

SERVICE MANUAL

T-88V CIRCUIT DESCRIPTION

Power Supply

The mains input to the tuner goes via power switch to the mains transformer which has two windings:

1. A 12 volt winding for the panel lamps.
2. Q225 (2SD235) transistor is used as a regulator to obtain from 17 volt to a 12 volt DC supply for AM and FM tuner section.

AM Section

A superhet design using a mixer/local oscillator and two stages of IF amplifications at 455KHz. A ferrite rod antenna with 3 windings is used, the first winding is connected to the external antenna terminal, the second is connected to the first section of a 2 gang tuning condenser, the last winding feeding the base of the mixer transistor.
The oscillator operates at 455KHz above the incomming signal to produce the intermediate frequency, which is passed through a ceramic filter and then amplified by two further transistor IF stages. The audio is then recovered by a D216 germanium diode detector and passed on to the pre-amp via selector switch, and signal strength meter is driven from a D215 germanium diode detector. An AGC voltage which is detected at the D217 and D218 controls the gain of the first IF amplifier, two diodes D213 and D214 are used for increasing the AGC effect. This method used provides an audio output relatively constant with varying RF signal strength.

FM Front-end

An input balun transformer matches either 300-ohm or 75-ohm antenna input to the front-end, which has a 4 gang tuning capacitors and consists of a FET for the tuned RF amp feeding, via a two section transformer, the bi-polar transistor "Colpitts" oscillator operates at 10.7MHz above the incomming signal. C115, C116, C117 and C118 are negative temperature coefficient condensers to stabilize the oscillator to less than 25KHz per 10 deg. Celsius. The output is then fed via 3pF condenser to the mixer, the resultant 10.7MHz passes through a double tuned IFT included in the front-end module. The front-end module is well shielded to prevent any spurious radiation, and to offer good image and selectivity response.

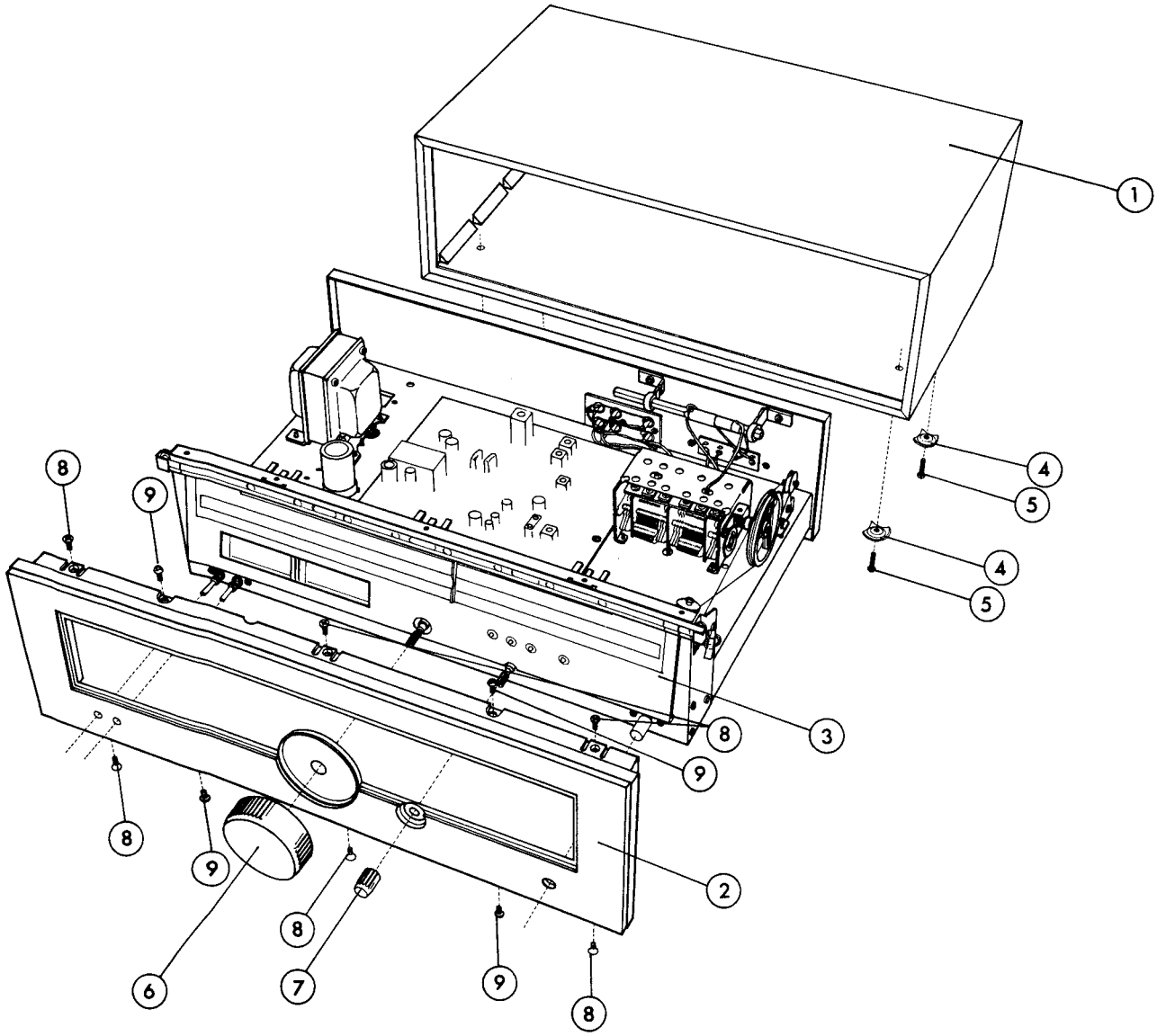
FM IF and MPX Sections

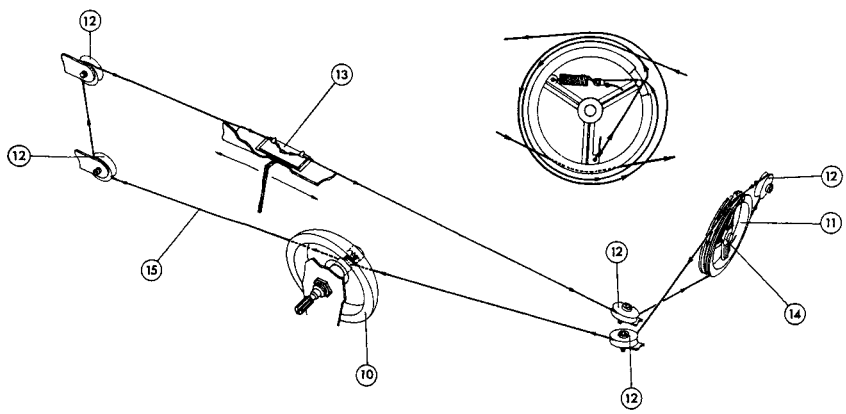
The IF strip is contained on the same printed circuit board as the AM, the stereo multiplex decoder and muting circuit. The L0.7MHz IF intermediate frequency is amplified by a transistor Q214 then passed through a ceramic filter with a side chain AGC amplifier to provide a DC control voltage for the RF input FET to improve the front-end overload capabilities. The main chain is again amplified by a further transistor and ceramic filter providing a wide pass band with steep sides.
At the audio output when the receiver is off-tuned from centre either a positive or negative DC will appear which is monitored both by a centre tune meter and a bi-phase detector using one NPN and one PNP transistor which with another NPN forms an "AND" gate for one of two "shmitt" trigger circuits. The other shmitt trigger receives a command from the signal strength circuit previously mentioned. The collectors of the final transistor in each circuit form a "wired OR" gate which via the muting "on-off" switch on the front panel controls the gate on the FET audio mute circuit if it is enabled. The composite audio passes on to the PLL stereo demodulator, which will derive the L and R audio output, the PLL stereo demodulator also is connected directly to the stereo indicator lamp.
The Left and Right go through L.C, type rejection filters to remove the 19KHz pilot. These are both in one moulding. Finally, a one transistor amplifier is used in each channel to raise the level to 1.6V for the audio preamp.

STEP	Signal Source Connected to	Set Signal to	Set Radio Dial to	Output Indicator Connected to	Adjust	Adjust for
1	Set selector switch to "FM", muting switch to "off", and turn power switch "on".					
2				DC VTVM PB1004 (19)		Check that voltage is between 11.2 - 12.0V
3						Check voltage at each part
4	Sweep Generator PB1004 (15)	±400KHz sweep centered at 10.7MHz Generator output level 90 - 100dB	Quiet point on band	Oscilloscope PB1004 TP201		Due to the fixed frequency of the ceramic filters, find the center frequency of a symmetrical band pass response. Make a note of it (for example 10.75MHz)
5				Oscilloscope PB1004 TP203	T201 T202 core	Symmetrical response centered at the frequency noted by step 4.
6				Oscilloscope PB1004 TP205	T203 top core T203 bottom core	Maximum linearity and amplitude of "S" curve centered at the frequency noted by step 4
7	FM Signal Generator Across FM antenna terminals(300-ohm) through matching net work	Reduce the output level to zero (interstation receiving condition)	93MHz		T203 top core	Center indication of the tuning meter
8		93MHz at 400Hz 100% modulation, output level 1mV		Oscilloscope DistortionMeter AC VTVM OUT	T203 bottom core	Minimum distortion. At the minimum distortion setting, the output level must be within 1/2dB of peak output.
9	Repeat steps 8 and 9 as necessary to obtain maximum output level and minimum distortion at center point of tuning meter and the meter must also shows center at interstation state.					
10	FM Signal Generator Across FM antenna terminals(300-ohm) through matching network	88MHz at 400Hz 100% modulation, generator output level 1mV	88MHz	Oscilloscope DistortionMeter AC VTVM OUT	T204 core	The signal strength meter must indicate its maximum, at the same time as the center tune meter indicates center.
11					L102	Accurate indication of pointer on dial to within ±1 pointer width
12		108MHz at 400Hz 100% modulation, generator output level 1mV	108MHz		TC102	
13		88MHz at 400Hz 100% modulation, generator output level 5-10uV	88MHz		T103 top core T103 bottom core T101, T102	Maximum indication of signal strength meter
14					L101	

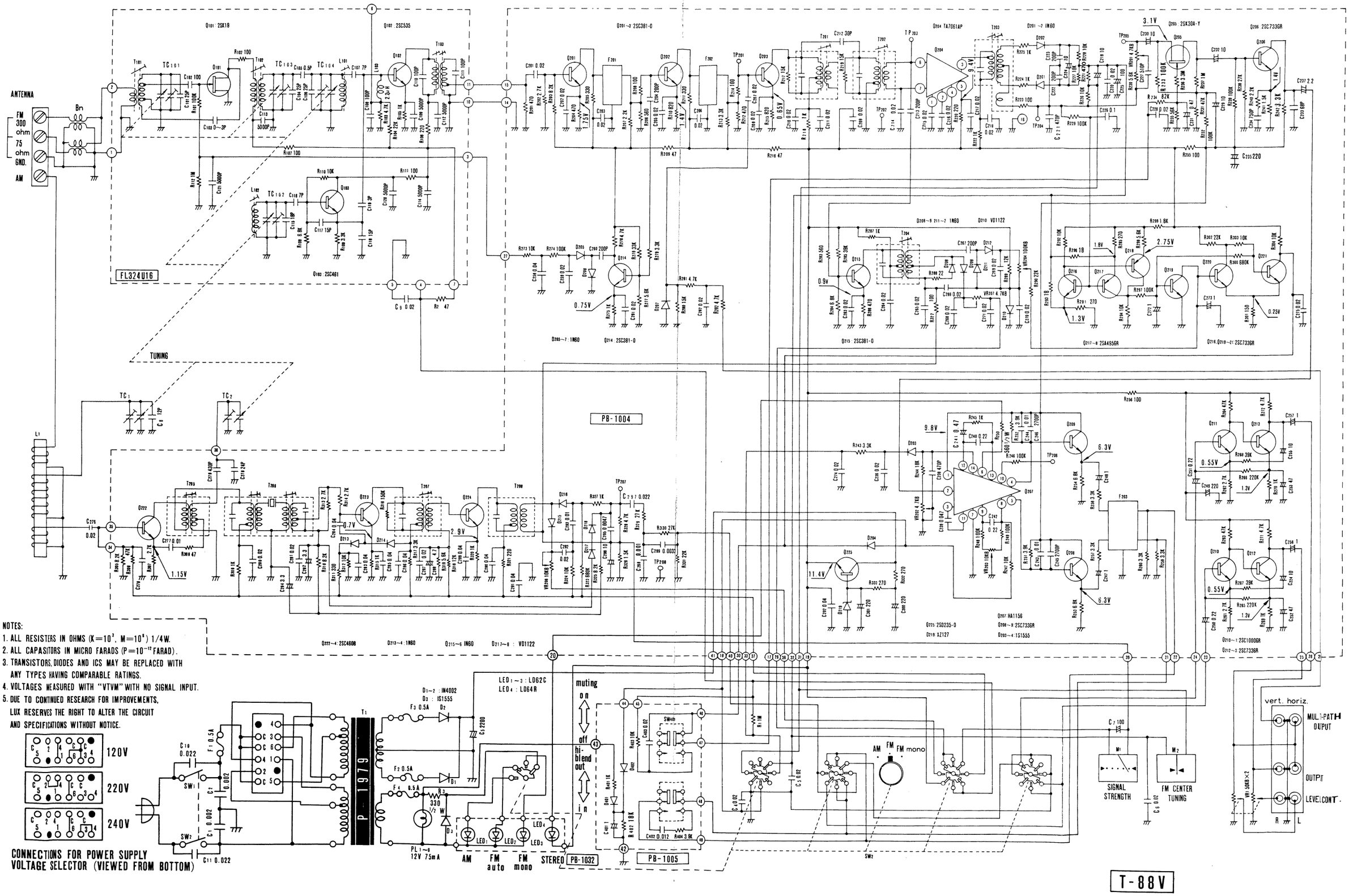
STEP	Signal Source Connected to	Set Signal to	Set Radio Dial to	Output Indicator Connected to	Adjust	Adjust for
15	FM Signal Generator Across FM antenna terminals(300-ohm) through matching network	108MHz at 400Hz 100% modulation generator output level 5 - 10uV	108MHz	Oscilloscope DistortionMeter AC VTVM OUT	TC103	Maximum indication of signal strength meter
16					TC104	
17					TC101	
18	Repeat steps 10 - 17 as necessary to obtain correct tuning on dial and the maximum indication of signal meter with uniform sensitivity throughout the band					
19	FM Signal Generator Across FM antenna terminals(300-ohm) through matching network	Reduce the output level to zero (interstation receiving state)	93MHz	Oscilloscope DistortionMeter AC VTVM OUT	T203top core	Center indication of the tuning meter
20		93MHz at 400Hz 100% modulation, output level 1mV			T203 bottom core	Minimum distortion. At the minimum distortion setting, the output level must be within 1/2dB of peak output
21		88MHz at 400Hz 100% modulation	88MHz			IHF maximum usable sensitivity which is the minimum output level of FMSG required for distortion and noise to be -30dB of total output
22		108MHz at 400Hz 100% modulation	108MHz			
23	Set muting switch at "on"					
24	FM Signal Generator Across FM antenna terminals(300-ohm) through matching network	98MHz at 400Hz 100% modulation, generator output level 1mV	98MHz	Oscilloscope AC VTVM OUT	VR205	Adjust to read 90% of full scale of meter
25		98MHz at 400Hz 100% modulation output level 7 uV			VR204	Fix VR204 at the point where output signals appear (muting adjustment)
26	Set selector switch to "FM auto", muting switch to "off"					
27	FM Signal Generator Across FM antenna terminals(300-ohm) through matching network	98MHz at 400Hz 100% modulation, generator output level 1mV	98MHz	Frequency Counter	VR202	Adjust VR202 until 19.00KHz is read at TP206 on the frequency counter
28		98MHz at 19KHz 10% L(or R) stereo 90% modulation output level 1mV	98MHz	Oscilloscope AC VTVM OUT	VR201	Maximum separation
29		98MHz at 19KHz 5% L (or R) stereo 90% modulation output level 1mV			VR203	Adjust VR203 until the stereo indicator lamp lights up
30	Set selector switch to "AM" position					
31	Adjust VR206 at its extreme counter-clockwise position					

STEP	Signal Scource Connected to	Set Signal to	Set Radio Dial to	Output Indicator Connected to	Adjust	Adjust for
32	Sweep Generator TC1, through luF mylar capacitor	±20 - 25KHz sweep centered at 455KHz generator output level 3mV	Quiet point on band near 1600KHz	Oscilloscope PB1004 TP207	T206	Maximum amplitude Do not adjust for two humps Symmetrical response with flat top
33	AM Signal Generator Standard radiating loop antenna placed near AM built-in antenna	600KHz at 400Hz 30% modulation field strength 50dB/m	600KHz	Oscilloscope AC VTVM OUT	T205 core	Accurate indication of pointer on dial to within ± 1 pointer width
34					L1 core	Maximum reading on AC VTVM
35		1400KHz at 400Hz 30% modulation, field strength 50dB/m	1400KHz		TC 2	Accurate indication of pointer on dial to within ± 1 pointer width
36					TC 1	Maximum reading on AC VTVM
37	Repeat steps 33 - 36 as necessary to obtain exact tuning on dial scale and maximum sensitivity					
38	AM Signal Generator Standard radiating loop antenna placed near AM built in antenna	1000KHz at 400Hz 30% modulation, field strength 100dB/m	1000KHz		VR206	Adjust to read 90% of full scale of meter



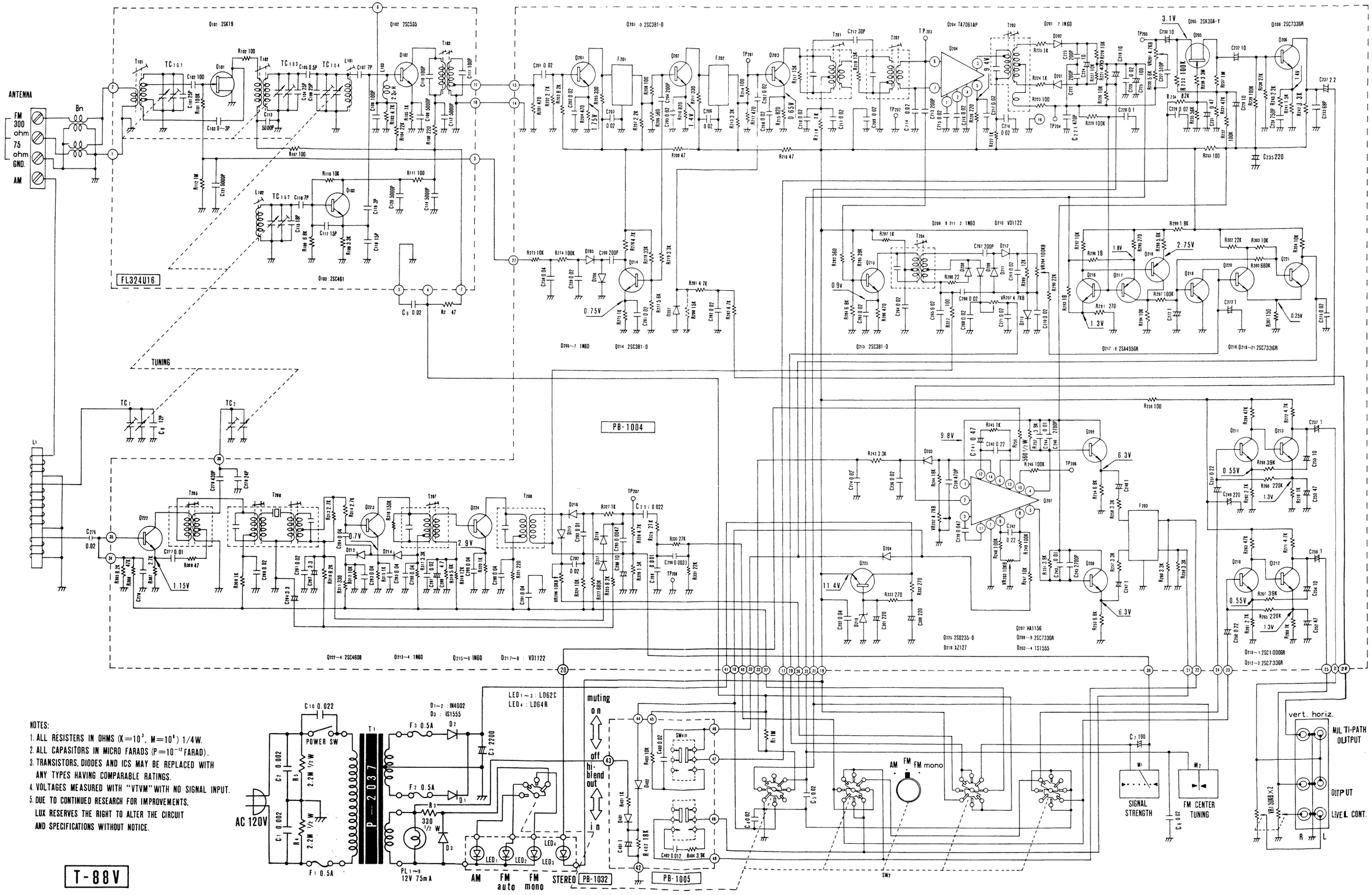


1 Cover
2 Pannel (Front Complete Ass'y)
3 Dial Scale
4 Washer 4mm
5 Screw 4mm x 15mm
6 Knob (Tuning)
7 Knob (Band Selector)
8 Screw 3mm x 6mm
9 Screw 3mm x 6mm
10 Tuning Shaft and Flywheel Ass'y
11 Drum (Tuning Capacitor)
12 Pully
13 Tuning Pointer Ass'y
14 Spring (Tension for Dial Cord)
15 Cord, Dial
16 Antenna for AM
17 FM Center Meter
18 Signal Meter
19 Power Trans # P-2037 U type model
P-1979 X type model
20 Type X model replaced by Voltage Selector



NOTES:

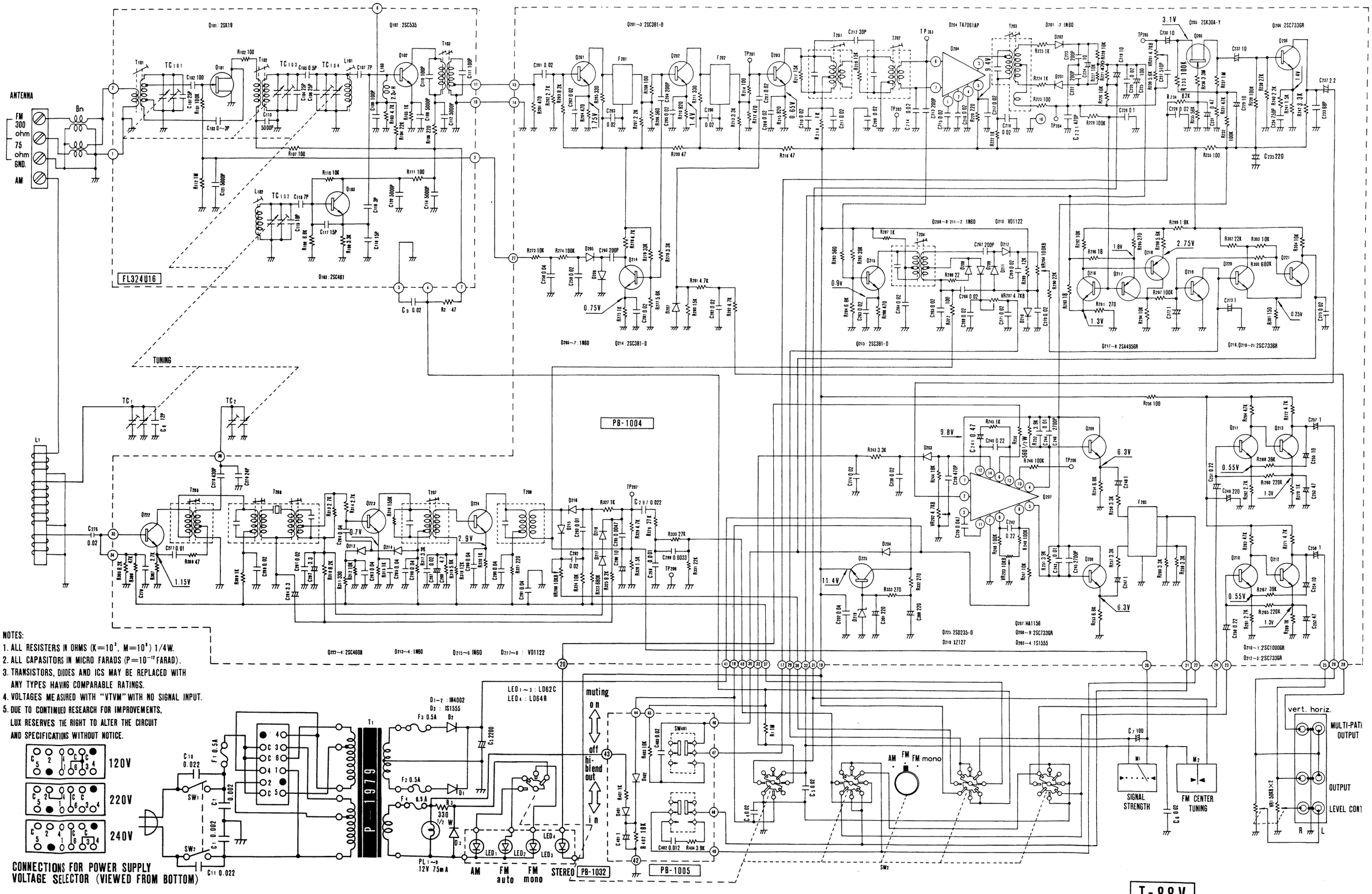
1. ALL RESISTERS IN OHMS (K=10^3, M=10^6) 1/4W.
2. ALL CAPASITORS IN MICRO FARADS (P=10^{-12} FARAD).
3. TRANSISTORS, DIODES AND ICS MAY BE REPLACED WITH ANY TYPES HAVING COMPARABLE RATINGS.
4. VOLTAGES MEASURED WITH "VTVM" WITH NO SIGNAL INPUT.
5. DUE TO CONTINUED RESEARCH FOR IMPROVEMENTS, LUX RESERVES THE RIGHT TO ALTER THE CIRCUIT AND SPECIFICATIONS WITHOUT NOTICE.

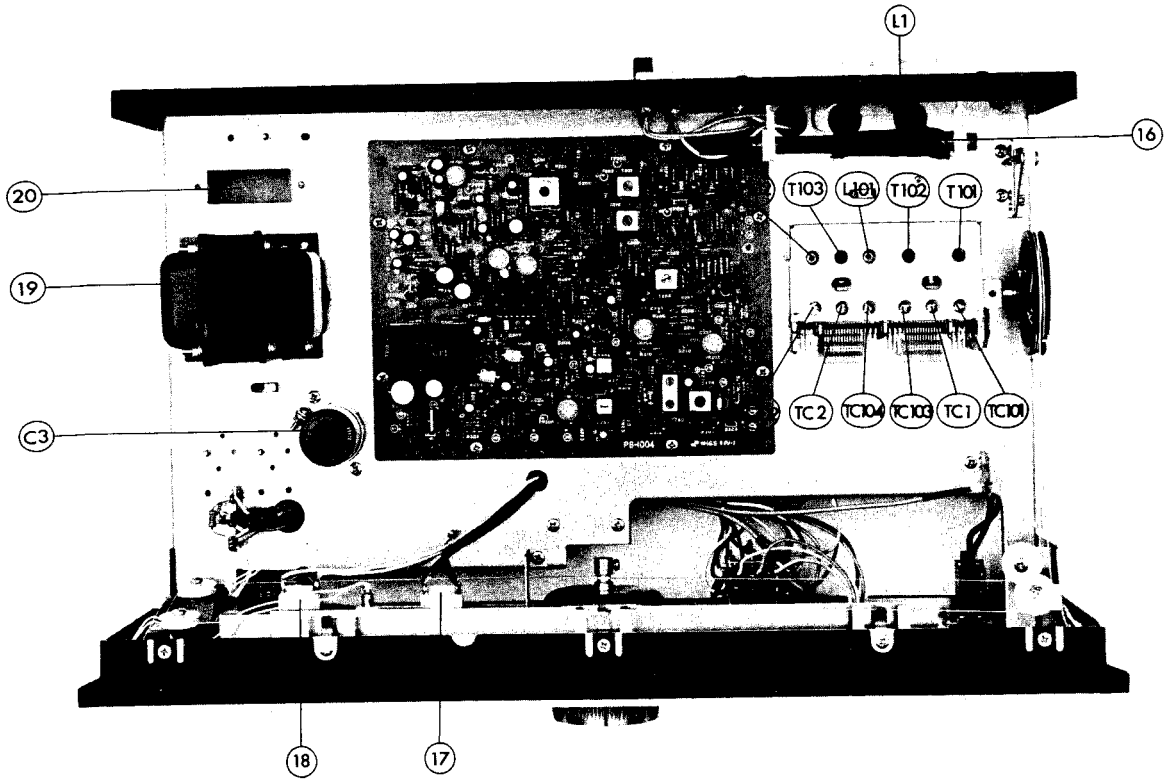


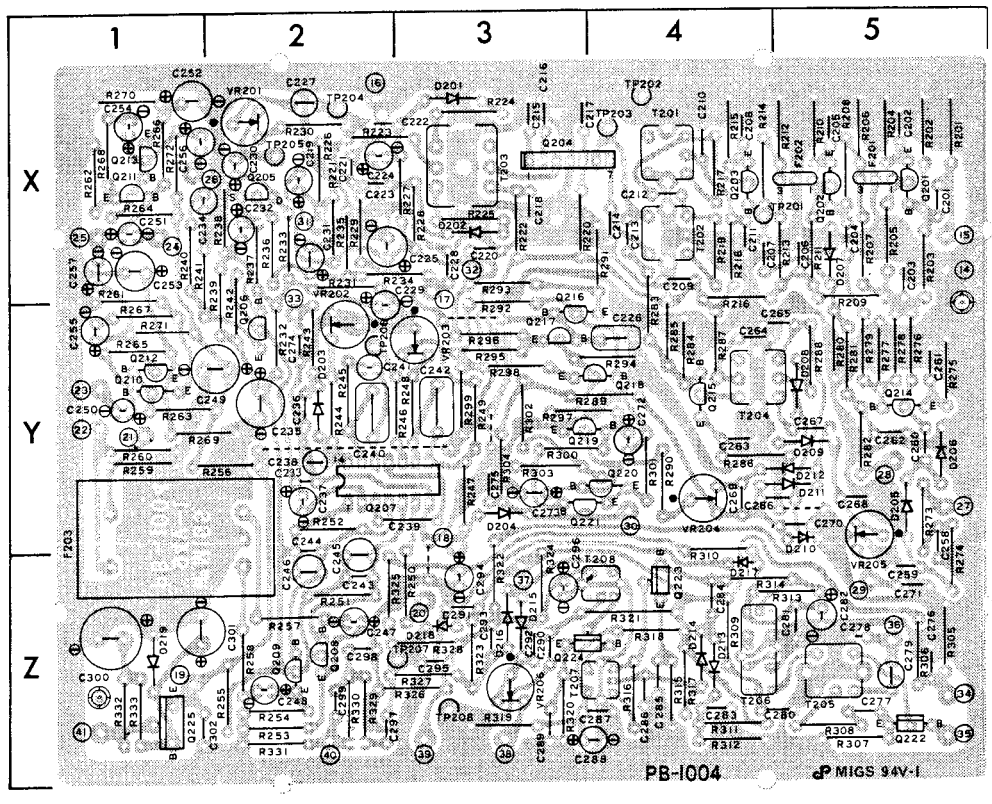
NOTES:

1. ALL RESISTERS IN OHMS (K=10^3, M=10^6) 1/4W.
2. ALL CAPASITORS IN MICRO FARADS (P=10^{-12} FARAD).
3. TRANSISTORS, DIODES AND ICS MAY BE REPLACED WITH ANY TYPES HAVING COMPARABLE RATINGS.
4. VOLTAGES MEASURED WITH "VTVM" WITH NO SIGNAL INPUT.
5. DUE TO CONTINUED RESEARCH FOR IMPROVEMENTS, LUX RESERVES THE RIGHT TO ALTER THE CIRCUIT AND SPECIFICATIONS WITHOUT NOTICE.

T-88V


ANTENNA
FM 300 ohm
75 ohm
GND.
AM
Bn
Q101 : 2SK19
Q102 : 2SC535
Q103 : 2SC461
FL324U16
TUNING
TC1
TC2
C9 12P
L1
Q201~3 2SC381-0
Q204 TA7061AP
Q205 2SK30A-Y
Q206 2SC733GR
Q207 HA1156
Q208~9 211~2 1N60
Q210 VD1122
Q214 2SC381-0
Q215 2SC381-0
Q216,Q219~21 2SC733GR
Q217~8 2SA495GR
Q222~4: 2SC460B
Q223: 2SD235-0
Q225~6 1N60
Q227~8 VD1122
D218: XZ127
D213~4: 1N60
D217~8 : VD1122
PB-1004
PB-1005
PB-1032
PB-1033
P-1979
T1
SW1
SW2
SW401
LED1~3 : LD62C
LED4 : LD64R
muting
on
off
hi-blend
out
in
AM
FM auto
FM mono
STEREO
SIGNAL STRENGTH
FM CENTER TUNING
AM
FM
FM mono
vert.
horiz.
MULTI-PATH OUTPUT
OUTPUT
LEVEL CONT
R
L
3.1V
9.4V
9.8V
6.3V
11.4V
2.75V
1.8V
1.3V
0.9V
0.25V
0.55V
0.75V
1.15V
0.7V
2.9V
1.4V
1.5V
0.65V
1.75V
NOTES:
1. ALL RESISTERS IN OHMS (K=10³, M=10⁶) 1/4W.
2. ALL CAPASITORS IN MICRO FARADS (P=10⁻¹² FARAD).
3. TRANSISTORS, DIODES AND ICS MAY BE REPLACED WITH ANY TYPES HAVING COMPARABLE RATINGS.
4. VOLTAGES MEASURED WITH "VTVM" WITH NO SIGNAL INPUT.
5. DUE TO CONTINUED RESEARCH FOR IMPROVEMENTS, LUX RESERVES THE RIGHT TO ALTER THE CIRCUIT AND SPECIFICATIONS WITHOUT NOTICE.
120V
220V
240V
CONNECTIONS FOR POWER SUPPLY VOLTAGE SELECTOR (VIEWED FROM BOTTOM)
T-88V


L1
16
20
19
C3
T103
T102
T101
TC2
TC104
TC103
TC1
TC101
18
17


1
2
3
4
5
X
Y
Z
PB-1004
MIGS 94V-1

PB-1004

REPLACEMENT PARTS & LOCATION

RESISTORS; ±10% 1/4 watt deposited carbon, unless noted otherwise.

SYMBOL NO.								
R201	470	X5	R240	2.2K	X1	R279	33K	Y5
202	2.7K	X5	241	1.5K	X1	280	15K	Y5
203	8.2K	X5	242	3.3K	Y2	281	4.7K	Y5
204	470	X5	243	3.3K	Y2	282	4.7K	Y5
205	330	X5	244	18K	Y2	283	560	Y4
206	560	X5	245	1K	Y2	284	6.8K	Y4
207	2.2K	X5	246	100K	Y2	285	39K	Y4
208	100	X5	247	10K	Y3	286	470	Y4
209	47	Y5	248	100K	Y3	287	1K	Y4
210	820	X5	249	100K	Y3	288	22Ω	Y4
211	330	X5	250	56K1/2W	Z3	289	12K	Y4
212	470	X5	251	3.9K	Y2	290	22K	Y4
213	3.3K	X5	252	3.9K	Y2	291	270	X4
214	100	X4	253	6.8K	Z2	292	10K	Y3
215	820	X4	254	6.8K	Z2	293	18	X3
216	47	Y4	255	100	Z2	294	10K	Y4
217	15K	X4	256	100	Y2	295	270	Y3
218	1K	X4	257	3.3K	Z2	296	18	Y3
219	15K	X4	258	3.3K	Z2	297	100K	Y3
220	220	X3	259	3.3K	Y1	298	5.6K	Y3
221	470	X2	260	3.3K	Y1	299	1.8K	Y3
222	1K	X3	261	2.7K	X1	300	680K	Y3
223	100	X2	262	2.7K	X1	301	150	Y4
224	1K	X3	263	47K	Y1	302	22K	Y3
225	1K	X3	264	47K	X1	303	10K	Y3
226	10K	X3	265	220K	Y1	304	10K	Y3
227	10K	X3	266	220K	X1	305	8.2K	Z5
228	10K	X3	267	39K	Y1	306	47K	Z5
229	100K	X2	268	39K	X1	307	2.7K	Z5
230	5.6K	X2	269	1K	Y1	308	47	Z5
231	47K	X2	270	1K	X1	309	1K	Z4
232	100K	X2	271	4.7K	Y1	310	8.2K	Z4
233	100K	X2	272	4.7K	X1	311	330	Z4
234	82K	X2	273	10K	Y5	312	10K	Z4
235	56K	X2	274	100K	Z5	313	2.7K	Z5
236	3.3M	X2	275	1K	Y5	314	2.7K	Z4
237	1M	X2	276	4.7K	Y5	315	1K	Z4
238	27K	X2	277	5.6K	Y5	316	150K	Z4
239	100K	X2	278	33K	Y5	317	3.3K	Z4
R318	12K	Z4	R327	1K	Z3	R 1	1M	
319	5.6K	Z3	328	4.7K	Z3	2	47	
320	1K	Z3	329	27K	Z2	3	330 1/2W	
321	220	Z4	330	27K	Z2	4(U)	2.2M 1/2W	
322	100	Z4	331	22K	Z2	5(U)	2.2M 1/2W	
323	680K	Z3	332	270	Z1			
324	10K	Z3	333	270	Z1			
325	8.2K	Z2						
326	1.5K	Z3						

CAPACITORS

E...electrolytic, C...ceramic, S...styrol, T...tantalum, M...mylar

C201	0.02	+80%-20%	25V	C	X5	C219	10	+50%-10%	16V	E	X2	C237	2.2	+50%-10%	16V	E	Y2
202	0.02	"	"	C	X5	220	0.02	+80%-20%	25V	C	X3	238	470p	+5%-5%	25V	S	Y2
203	0.02	"	"	C	X5	221	470p	+20%-20%	25V	C	X2	239	0.047	+10%-10%	50V	M	Y3
204	200P	+10%-10%	25V	C	X5	222	200p	+10%-10%	25V	C	X2	240	0.22	"	50V	M	Y2
205	0.02	+80%-20%	25V	C	X5	223	200p	"	"	C	X2	241	4.7	+50%-20%	6.3V	T	Y2
206	0.02	"	"	C	X5	224	10	+50%-10%	16V	E	X2	242	0.22	+10%-10%	50V	M	Y3
207	0.02	"	"	C	X4	225	100	"	"	E	X2	243	0.01	"	50V	M	Z2
208	0.02	"	"	C	X4	226	0.1	+10%-10%	50V	M	Y4	244	0.01	"	"	M	Y2
209	0.02	"	"	C	X4	227	510p	+5%-5%	250V	S	X2	245	2700p	+5%-5%	25V	S	Z2
210	0.02	"	"	C	X4	228	0.02	+80%-20%	25V	C	Y3	246	2700p	"	"	S	Z2
211	0.02	"	"	C	X4	229	10	+50%-10%	16V	E		247	1	+75%-10%	50V	E	Z2
212	30P	+10%-10%	25V	C	X4	230	10	+50%-20%	16V	T	Y2	248	1	"	"	E	Z2
213	200p	"	"	C	X4	231	0.47			E	Y2	249	220	+50%-10%	16V	E	Y1
214	0.02	+80%-20%	25V	C	X4	232	10	+50%-20%	16V	T	Y2	250	0.22	+50%-20%	35V	T	Y1
215	0.02	"	"	C	X3	233	68p	+10%-10%	250V	C	Y2	251	0.22	"	"	T	X1
216	0.02	"	"	C	X3	234	750p	+5%-5%	250V	S	X1	252	47	+50% -10%	16V	E	X1
217	0.02	"	"	C	X3	235	220	+50%-10%	16V	E	Y2	253	47	"	"	E	X1
218	0.02	"	"	C	X3	236	0.02	+80%-20%	25V	C	Y2	254	10	"	"	E	X1

C255	10	+50%-10%	16V	E	Y1
256	1	+75%-10%	50V	E	X1
257	1	"	"	E	X1
258	0.04	+80%-20%	25V	C	Y5
259	0.02	"	"	C	Z5
260	200p	+10%-10%	"	C	Y5
261	0.02	+80%-20%	"	C	Y5
262	0.02	"	"	C	Y5
263	0.02	"	"	C	Y4
264	0.02	"	"	C	Y4
265	0.02	"	"	C	Y4
266	0.02	"	"	C	Y4
267	200p	+10%-10%	25V	C	Y5
268	0.02	+80%-20%	25V	C	Y5
269	0.02	"	"	C	Y4
270	0.02	"	"	C	Y5
271	0.02	"	"	C	Z5
272	1	+75%-10%	16V	E	Y4
273	1	"	"	E	Y3
274	0.02	+80%-20%	25V	C	Y2
275	0.02	"	"	C	Y3
276	0.02	"	"	C	
277	0.01	"	"	C	Z5
278	24p	+10%-10%	"	C	Z5

C279	430p	+5%-5%	25V	S	Z5
280	0.02	+80%-20%	25V	C	Z4
281	0.02	"	"	C	Z5
282	3.3	+75%-10%	25V	E	Z5
283	0.04	+80%-20%	25V	C	Z4
284	0.04	"	"	C	Z4
285	0.04	"	"	C	Z4
286	0.04	"	"	C	Z4
287	0.02	"	"	C	Z4
288	4.7	+75%-10%	25V	E	Z4
289	0.04	+80%-20%	"	C	Z3
290	0.04	"	"	C	Z3
291	0.04	"	"	C	Z3
292	0.02	"	"	C	Z3
293	0.01	"	"	C	Z3
294	3.3	+75%-10%	25V	C	Z3
295	0,0047	+10%-10%		M	Z3
296	10	+50%-10%	16V	E	Z3
297	0.02	+10%-10%		M	Z2
298	0.001	"		M	Z2
299	0.0033	"		M	Z2
300	220	+50%-10%	16V	E	Z1
301	220	"	"	E	Z1
302	0.04	+80%-20%	25V	C	Z1

C 1	2200p	[oil(X), film(U)]			
2	2200p	[oil(X), film(U)]			
3	2200	+50%-10%	25V	E	
4	0.02	+80%-20%	25V	C	
5	0.02	"	"	C	
6	0.02	"	"	C	
7	100	+50%-10%	16V	E	
8	12p	+10%-10%	25V	C	
9	0.02	+80%-20%	25V	C	
10	0.022				
11	0.022				

TRANSISTORS & IC's

Q201	2SC381	X5
202	2SC381	X5
203	2SC381	X4
204	TA7061AP	X3
205	2SK30A	X2
206	2SC733	Y2
207	HA1156W	Y2
208	2SC733	Z2
209	2SC733	Z2
210	2SC1000	Y1
211	2SC1000	X1
212	2SC733	Y1
213	2SC733	X1
214	2SC381	Y5
215	2SC381	Y4
216	2SC733	Y3
217	2SA495	Y3
218	2SA495	Y4
219	2SC733	Y3
220	2SC733	Y3
221	2SC733	Y3
222	2SC460	Z5
223	2SC460	Z4
224	2SC460	Z3

DIODES

D201	IN60	X3
202	IN60	X3
203	IS1555	Y2
204	IS1555	Y3
205	IN60	Y5
206	IN60	Y5
207	IN60	X5
208	IN60	Y5
209	IN60	Y5
210	VD1122	Y5
211	IN60	Y5
212	IN60	Y5
213	IN60	Z4
214	IN60	Z4
215	IN60	Z3
216	IN60	Z3
217	VD1122	Z4
218	VD1122	Z3
219	WZ120	Z1

D 1	IN4002	chassis
2	IN4002	chassis
3	IS1555	chassis

L.E.D.'s

LED 1	LD62C
LED 2	LD62C
LED 3	LD62C
LED 4	LD64R

VARIABLE RESISTORS

VR201	4.7K-B	X2
202	4.7K-B	Y2
203	10K-B	Y3
204	100K-B	Y4
205	4.7K-B	Y5
206	10K-B	Z3
VR 1	50K-B x 2	chassis

SWITCH

SW401	2-2	push sw
SW402	2-2	push sw
SW 1		push sw
SW 2	4-8-3	rotary sw

TRANSFORMER & FILTERS

T1	power trans	chassis
	P-1979 (E)	
	P-2037 (U)	
T201	154AC-40716N	X4
202	154AC-40716N	X4
203	MV4FCC-20600BW	X3
204	154AC-40783AIS	Y4
205	RWR-41097A	Z5
206	CFT-455B	Z4
207	7LC-352713N9	Z4
208	159GC-1008A	Z4

T101	FM ANT COIL	FM frontend
102	FM RF COIL	FM frontend
103	FM IFT	FM frontend
L101	FM RF COIL	FM frontend
102	FM OSC COIL	FM frontend
L 1	5638	

F201	CFSA-30AC-10	X5
202	CFSA-30AC-10	X5
203	LUX-14562	Y1

PB-1005

R401	1K	+10%-10%	1/4W	deposited	carbon
402	18K	"	"	"	"
403	10K	"	"	"	"
404	3.9K	"	"	"	"

C401	1u	+75%-10% 50V E
402	0.012	+10%-10% 50V M
403	0.02	+80%-20% 25V C

D401	IN60 diode
402	IS1555 diode

LUX CORPORATION, JAPAN

HEAD OFFICE & FACTORY 1-8-31 NAGAHASHI, NISHINARI-KU, OSAKA
PHONES: 632 0031 CABLE: LUXELECT OSAKA
TELEX: J63694

LUX AUDIO OF AMERICA LTD.

200 AERIAL WAY, SYOSSET, NEW YORK 11791, U.S.A.
PHONE: (516)822-7070

Printed in Japan